

## **Spatial Data Infrastructures in South East Europe – Creating a Potential for the Development of Transition Countries**

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### **ABSTRACT**

This paper addresses spatial data infrastructures in South East Europe. This geographical region comprises the countries Albania, Bosnia-Herzegovina, Bulgaria, Croatia, Macedonia, Romania, Turkey and Yugoslavia. In the long term, these countries are aiming at becoming members of the European Union, and spatial data will play a significant role in the development of the economy. The project GISEE, funded by the European Commission, investigates the status of access and use of spatial data and will propose recommendations for establishing national and regional spatial data infrastructures. This paper summarizes the status of the spatial data infrastructures in South East Europe as resulting from a survey, its analysis and an overview of the recommendations for the future development of spatial data infrastructures in the region. The paper presents also activities that the authors have designed to build on the results of the GISEE project and to move towards regional spatial data infrastructures.

### **INTRODUCTION**

Spatial information is an important economic factor, and has a considerable impact especially in transition countries on the development towards a market economy. Ownership of land, development of infrastructure, water and electricity distribution, environmental planning, town planning, business development - spatial information is an important factor for the development of countries towards higher living standards, a fully functioning market economy and participatory democracy. Donors such as the European Commission, the World Bank and many others support those countries in their transition phase; however, without data about location, many donor supported projects cannot be executed effectively.

The goal of this paper is to report about the authors' work on building spatial data infrastructures in South East Europe. A spatial data infrastructure is understood as encompassing the policies, organisational remits, data, technologies, standards, delivery mechanisms, and financial and human resources necessary to ensure that those working at the global and regional scale are not impeded in meeting their objectives. The geographical region considered comprises the countries Albania, Bosnia-Herzegovina, Bulgaria, Croatia, Kosovo, Macedonia, Romania, Serbia & Montenegro and Turkey. Three of these countries, Bulgaria, Romania and Turkey, are candidate countries to the European Union, whereas the other countries lie in the Western Balkan region and are also aspiring EU membership. In these countries, data is not generally accessible and knowledge and awareness of the importance of spatial data is lacking.

#### **THE PROJECT GISEE (GIS TECHNOLOGY AND MARKET IN SOUTH EAST EUROPE)**

The study project GISEE (contract IST 2001 – 37994) intends to bridge this gap by investigating the status of the spatial data infrastructures in South East Europe. It is financed under contract IST-2001-37994 by the fifth framework programme of the European Commission, and has started in September, 1<sup>st</sup> 2002. The overall aim is to provide a comprehensive documentation of spatial data infrastructures in the target countries, describing data, actors and applications. An analysis presents obstacles and the favorable conditions for the use and deployment of GIS technology, the lack and the need for standardization and for harmonization of business processes. Differences and the common issues between the countries will be determined, prospects for further developments provided and necessary future activities and policy recommendations for the region in this sector defined.

The analysis will lead to concrete proposals to fully establish this infrastructure and to use it for the benefit of the region. The project will provide a roadmap and policy recommendations not only to actors in the sector of Geographic Information, but to all decision makers, to governments and donors, that they take these policy recommendations into account for the definition of future policy and projects of all kind.

The Technical University of Sofia is working in this project together with GISIG, the Italian based "Geographic Information Systems International Group", with members from all over Europe, with Eurogeographics, the association of the European Mapping Agencies with 40 members in 38

countries, and with the Bulgarian IT consultancy company URSIT Ltd. These partners are supported by national coordinators in each country.

The results of the project will be made available in a public final report and be accessible via the World Wide Web site <http://www.gisig.it/gisee>. The work will lead to a network of GIS actors in the region, who continue to work on those issues, and to the introduction of standards and modern technology. This will be the major theme of the international conference “South East European Spatial Data Infrastructure Conference 2003”, organized in the frame of the GISEE project, which will take place in Sofia in October, 23rd – 24th 2003. Aspects of harmonization and the establishment of a spatial data infrastructure in South East Europe will be discussed.

#### **RELATED ACTIVITIES**

GISEE is focused on the countries of South East Europe, but the project is clearly positioned among European initiatives aimed at establishing a European spatial data infrastructure. On the most general level, the eEurope Action Plan 2005, resulting from the European Unions’ summit meeting in Lisbon in 2000, aims to create a digital Europe and to stimulate secure services, applications and content based on widely available broadband infrastructure, and lays thus a general framework for any activity in the Information Society.

Rather independent from eEurope, two recent and important initiatives from the European Commission had great impact on the discussions about European spatial data infrastructures. The first one is the legal directive on the re-use and commercial exploitation of public sector information. It includes measures for ensuring fair trading and for a level playing field where a public sector body has commercial activities. The European Commission believes that the spatial data market will benefit from this legal directive and estimates its size as Euro 10 billion per annum over the 15 member states.

Another important stimulus has come from the Directorate General Environment of the European Commission, with its Water Framework Directive. This Directive may be one of the most important pieces of legislation for its implication in respect to the availability of spatial data across Europe. It aims at protecting and enhancing the quality of underground and surface water in Europe.

The Water Framework Directive has led to a further initiative, INSPIRE (*IN*frastructure for *SP*atial *Info*Rmation in *EU*rope), which is launched by

the same Directorate General of the European Commission and should become a Directive for spatial information in Europe. INSPIRE is driven by the thinking that it will lead to the provision of harmonized spatial data to support the Water Framework Directive, and that this will also become the basis to support other key policy areas of the Union, such as transport, agriculture, regional policy, e-government. INSPIRE has created a political momentum that has astonished even the most critical observers of EU policy. INSPIRE is important also for the current and future accession countries and some of them have contributed to INSPIRE.

The initiative intends to trigger the creation of a European spatial information infrastructure that delivers to users integrated spatial information services. These services should allow the users to identify and access spatial or geographical information from a wide range of sources, from the local level to the global level, in an interoperable way for a variety of applications. The availability of a European Spatial Information Infrastructure, combined with the rapidly expanding possibilities of Internet access would become a new means for communicating with the citizen about issues of concern for all policies with a territorial dimension.

Before any of such initiatives can be implemented, an overview of the state of play has to be provided. EUROSTAT and the Directorate General of Environment are funding a study, carried out by the University of Leuven in Belgium. This survey will describe the situation of spatial data infrastructures in 32 European countries, i.e. the 15 EU-member states, 10 accession countries, 3 candidate countries and the 4 EFTA-countries. The University of Leuven and the GISEE project are working together for the description of the spatial data infrastructures that are common to both projects, i.e. Bulgaria, Romania and Turkey.

In addition to policy oriented initiatives, several projects have been launched that in their special areas contribute to the establishment of a European spatial data infrastructure. Of particular significance are ETemII (European Territorial Management Information Infrastructure), which focused on Europe-wide reference data, metadata, and interoperability, and was completed in 2002. The second project is GINIE (Geographic Information Network in Europe) started at the end of 2001, which pursues the support towards a European spatial data infrastructure oriented towards data policy and capacity building.

Eurogeographics, the association of European mapping agencies, initiated several projects to harmonize spatial data across Europe. EuroGlobalMap and EuroRegioMap are funded by the European Commission; EuroGlobalMap aims at the creation and maintenance of a pan-European base

map in the scale of 1:1 million. Mapping agencies from all over the world participate in this project. EuroRegioMap target specific regions of Europe and is to create a multi-functional, medium-scale (1:250,000) reference database of such region. More long term oriented is the project EuroSpec, aiming at achieving interoperability of all reference and other geo-located data, across boundaries, themes and resolution ranges. This initiative unites all European mapping agencies, but has only recently started.

GISEE is clearly related to all these initiatives and projects – not only are the GISEE partners in contact with these initiatives, GISEE is also a first and important step to inform actors in South East Europe about these initiatives and to harmonize data and activities in this region with those in the European Union. GISEE is thus playing a strong part in the accession of South East Europe to the European Union.

### **THE INFORMATION SOCIETY IN SOUTH EAST EUROPE**

Access to spatial data is normally provided by using existing telecommunications and Internet infrastructure. General Information Society laws such as copyright, intellectual property laws, access to information determines their access and use. Therefore, any Spatial Data Infrastructure depends on the Information Society and the latter has to be considered, too.

The telecommunications sector is in all countries dominated by the incumbent operator; privatisation is not completed, and seems to be problematic in all countries. This hampers not only the competition in the sector itself, but constitutes also an obstacle to the development of the telecommunications infrastructure and all applications built on top of this infrastructure. Reacting to this, mobile phone subscriptions are growing faster than subscriptions for fixed telephone lines.

The market of Internet service providers is liberalised in all countries, and a liberal and competitive market exists. Internet access is difficult to really measure, since it is used not only at home or in the office, but also in the many Internet cafes or telehouses that are proliferating in these countries. Costs for internet access are continuously falling; nevertheless, Internet access is still expensive for most people in transition economies. On the other hand, the use of dedicated lines for a faster Internet access is increasing. Broadband access is very rare.

Most countries have defined strategies for the Information Society, however, they had also to learn that implementation is weary, difficult and long. Major difficulties relate to financing and organizational issues. The citi-

zens' right to information is foreseen in the constitution of all countries considered. However, only few countries have explicitly issued relevant legislation. It seems that Albania and Bulgaria are the most advanced countries in this respect.

In summary, it has to be said that the telecommunications infrastructure in the region is weak and telecommunication services are not generally available, quality of service is poor, Internet connection is strongly growing, but it is accessible only to a minority; few web sites exist. Mobile networks are congested, particularly in Serbia. Despite these obstacles, many opportunities and a demand for new technology and for reconstruction using modern technology exist. The ICT sector is the one with the highest growth rate.

#### **SPATIAL DATA INFRASTRUCTURES IN SOUTH EAST EUROPE**

One of the goals of GISEE is to describe the state of play of spatial data infrastructures in the countries of South East Europe, which is presented in overview in this section.

##### **Survey of Spatial Data Infrastructures in South East Europe**

The terms of reference for the GISEE project have been defined in the report "Definition of Data and Information to be collected", which defines spatial data infrastructures and the data that should be collected by means of a survey. Subsequently, a questionnaire had been defined that would be sent to those organizations that participate in the creation, use and distribution of spatial data. Questions had been defined about the organizations themselves, their use of technology, the way they distribute data internally and externally, and the spatial data that they use, own or provide.

The survey was carried out by national coordinators in the eight target countries. These experts had also the responsibility to select their stakeholders, to distribute the questionnaires and to collect them. The results were entered into a web based survey tool that converted the results into a relational database, which in turn is used to analyse the survey results. It is important to note that never before such a survey has taken place in these countries, with the exception of Bulgaria, where a similar survey had been carried out several years ago, however, much less comprehensive.

At the time of writing this paper, the analysis of the survey has not ended yet. One important question is the one for representativeness and statistical significance of the survey. Data owners and providers at national level should be completely represented, with also a reasonable representation of

owners and providers at regional or local level. The authors believe that this goal has more or less been reached and that national organizations are in nearly all cases faithfully represented. Questionnaires from some local or regional authorities give insight into data existence in this place. Questionnaires have been collected from many private and public non-governmental organizations, and also from users. It was clear from the beginning that it would be impossible to include all possible users of spatial data.

Questionnaire collection has been problematic in many cases, since people are flooded with questionnaires from all kind of sources, and in our case, a lot of detail has been asked that people do not like to disclose. However, only the case of Albania must be considered non-representative: here, the governmental data owners are not represented among the respondents. From web surveys, the authors know that a lot of data exist in Albania, which is not expressed by the questionnaires collected. The situation was most difficult in Bosnia and Herzegovina, due to the unstable political situation.

In view of the fact that this is the first survey concerning spatial data, the authors believe that the results will provide good insight into the status of spatial data infrastructures in these countries and provide convincing clues for recommendations for future work.

### **Organizations and Stakeholders**

Spatial data infrastructures are to a large extent determined by the organizational and legal framework of a country or region. Responsibility for certain activities related to spatial data is assumed by ministries in the target countries; in only a few countries, specific institutions have been established. Before the demise of the communist regime, most responsibility lay within military organizations, called military topographic institute or service that still exist. Today, most activities are carried out by civil ministries. The most important ministries are in all countries the ministry of regional development, the ministry of agriculture and the ministry of environment. For the purposes of tax collection, ministries of finance work with cadastre data, and ministries of justice are in charge of national registries. However, these have to be considered as specific application oriented data usages.

Romania is in fact the most advanced country, having established its National Office for Cadastre, Geodesy and Cartography (NOCGC) with the broadest mandate for spatial data. In all other countries there is no single institution coordinating spatial data. In Bulgaria, the department of cadastre and geodesy of the Ministry of Regional Development and Public Works

has traditionally played a significant role. With the new “Law of United Cadastre of the Republic of Bulgaria”, issued in 2000, a “Cadastre Agency” has been established to be in charge of spatial data with the vision of becoming in the future a Bulgarian mapping agency. In Bosnia and Herzegovina, the “Federal Geodetic Administration” assumes the role of the major coordinator with respect to spatial data, with the “Geodetic Administration” of the Serb Republic acting in the Republika Srpska as the main coordinator. The situation is similar in Serbia and Montenegro, where the main functions are assumed by the “Directorate of Real Estate” in Montenegro, and the “Republic Geodetic Authority” in Serbia.

### **The legal Framework**

Specific Information Society legislation with significance for the spatial data sector is complete only in Albania and Bulgaria. In all other countries Information Society laws exist partially or are in preparation. Legislation specific for the spatial data sector exists in few countries only.

Bulgaria has issued its “Law of United Cadastre of the Republic of Bulgaria”, and created the agency for cadastre. Croatia does not have particular Information Society laws, but there is a new “Law of State Survey and Real Estate Cadastre”, which came into force in March 2000. It is accompanied by a set of special regulations, as well as a strategy for the further development of the cadastre.

However, we find in all countries legislation that is specific to the environment and also defines the access and the distribution of environmental information. The conclusion is that the environment is a driving force, as it is in the European Union. The second drive force is in fact the cadastre and land reform.

### **Technology and Standards**

Concerning the use of technology, no significant difference can be observed between different types of organizations, between the public or private sector or research and educational organizations.

It is no surprise that Microsoft Windows is the most used operating system; use of Unix and Linux is the exception. This applies also to the use of databases – in fact, Microsoft Access is the most used relational database for spatial applications. About 50% of the respondents use Access, independent of the nature of the organization. Oracle is on the second place, followed by SQL Server. In the private sector however, SQL server ranges before Oracle, probably because of price reasons. The situation does not vary much between the countries.

ESRI is the most widespread GIS system in nearly all countries, which also does not surprise. Overall, Autodesk assumes the second place. This order is reversed in Bosnia and Herzegovina, Macedonia and Serbia and Montenegro, where Autodesk is the most used system.

Research organizations prefer MapInfo on the third place, whereas administrations and companies use Intergraph software. Also Idrisi is used very often; many other GIS can be found, but they are used only to a very small extent. No clear champion could be found in Turkey, the most important providers seem to have roughly the same market share.

Standards are very well used, with ISO standards on top, followed by OpenGIS standards and national standards. Sometimes, organizations use vendor specific standards. It is however surprising to notice that CEN standards are not at all used.

### **Data**

Data of all types are available in South East Europe – the main problem is not the existence of the data, but the way to access it. There is no single organization that distributes data and data is difficult to find, and it is also difficult to understand access conditions. As a general rule, it is noted that universities do not own data, with very few exceptions. In Turkey, several universities are owners of data; they own thematic data or digital elevation models.

In all countries, data are provided either on CD or on paper, with other distribution media existing but used to a lesser extent. Internet for data distribution is rarely used, only in Romania it has become more important.

Data are expensive – in most cases, independent of the country, government organizations, not only commercial companies, sell data at market prices. Data licensing is often used, and a cost recovery model is used in Croatia, Serbia and Montenegro, to a lesser extent in Romania, Macedonia and Bosnia and Herzegovina. Only in Romania, many data can be obtained at marginal or transfer cost.

Spatial data is used in various applications, which varies between the countries. The following Tab 1 provides an overview of the dominant application sectors.

Land use and cadastre are important in all target countries; it can be further observed that all application sectors considered are found with nearly equal importance in Albania and Serbia and Montenegro, whereas in all other countries some sectors are more dominant than others, as displayed in Tab 1 below.

## Metadata

Metadata exists in abundance, however metadata is encoded in proprietary formats which makes general access difficult or impossible. Rarely, ISO 19115 is used. Albania makes an exception – the Albanian Geological Services and Seismological Institute use ISO standards, along with GML and SGML for their metadata. For metadata, the corresponding CEN standard is not used, although translation of CEN standards into the national languages has been financed by the European Commission.

Tab. 1: Most important application sectors per country

Application sector	Country
Governmental applications	Albania, Bulgaria, Macedonia, Serbia and Montenegro, Turkey
Research	Romania, Serbia and Montenegro
Education	Albania
Environment	Albania, Bulgaria, Croatia, Macedonia, Romania, Serbia and Montenegro
Disaster Management	Albania
Remote Sensing	Serbia and Montenegro, Romania
Geological Studies	Albania, Serbia and Montenegro,
Geodetic Control	Albania, Bosnia and Herzegovina, Serbia and Montenegro
Topographic map production	Albania, Bosnia and Herzegovina, Macedonia, Serbia and Montenegro, Turkey
Cadastral plans	Albania, Serbia and Montenegro

## THE WAY FORWARD AND FUTURE ACTIVITIES

The understanding of the situation of spatial data and their access conditions is the prerequisite for defining any way forward and any future action that would aim at creating spatial data infrastructures. As it has been demonstrated, data is present throughout the region, and all types of data can be found. However, there is no single data owner, no single organization that distributes data. Data ownership is found among governmental and private organizations. It is difficult to locate sources of data and difficult to understand the conditions of accessing them. The major weakness seems to be of organizational nature – in most countries, spatial data ownership and access is not coordinated and no single organization has the responsibility for spatial data ownership and distribution. Further, legislation lacks or is not pre-

cise enough to define access to spatial data. The environmental sector seems to be a driver in this respect since in most countries of South East Europe the legislation for the distribution and use of environmental spatial data is advanced, although it does not seem to be well known. A second driver is cadastre and land reform. Knowledge and awareness of the usage of spatial data and its advantages does not exist, and consequently, little funding or investment is provided to this sector.

Any future recommendation and initiative should address these weaknesses. Addressees of recommendations would be governments and donors in the first place, but also the private sector. Recommendations for future action would comprise:

- Cooperation and alignment with European initiatives. The most important ones are INSPIRE and the policy area around public sector information. It would be up to national governments to coordinate this.
- Creation of awareness. This would predominantly be done by national government or by a non-governmental organization active in the area of spatial data.
- Implementation of the necessary legislation, which is up to national government.
- Organizational measures undertaken by the government. In this respect, countries such as Romania with its National Office for Cadastre, Geodesy and Cartography (NOCGC), or Bulgaria with its Cadastre Agency can serve as examples for the establishment of government organizations devoted to spatial data.
- Encouragement of the private sector and use of spatial data in all sectors. Encouragement of the private sector is part of a government's or donors' agenda, and therefore donors as well as governments have to be made aware of the importance of spatial data that requirements are included in the specifications of donor and investment projects.

It may seem easy to ask national governments to change organizational structures and in particular to create a national mapping agency. However, in practice this would mean changing the current distributions chains, and the experience from countries like Romania or Bulgaria show that this is a very difficult process. Moreover, discussions are going on world wide on the role and organizational structure of mapping agencies, and their mandate for offering spatial data. Opinions are diverse and there is no single model that is proven to work and that could be recommended to be implemented. In view of this ongoing debate on the privatization of mapping

agencies, it may be preferable to follow this debate and to gather experience before proceeding to formally establishing any mapping agency.

Another, more realistic idea would be to set up in all countries a government agency with low staff that would have a more modest role in generally collecting and providing information. The role of such an agency could be to make information about data sources available, to be in charge of recommendations such as the inclusion of spatial data components in government investment projects, or the definition of procurement guidelines for spatial data and be an interface to donors. Government owned data should be registered with such an agency, which eventually could set up a meta data server. The agency could also be in charge of regional coordination of spatial data.

The more general question will be which role government and private sector would assume in the establishment of a spatial data infrastructure – would it be directed by the government or would the private sector take over the role of a driver. The authors believe that any spatial data infrastructure should serve market needs; consequently, the private sector in a competitive market should understand the benefits of using spatial data for revenue creation and be a major driver in the process of creating a spatial data infrastructure. In this respect, the private sector, i.e. companies active in the field as providers, users or integrators, could organize themselves to create one single voice towards customers and government, and to stimulate grass-root activities.

#### **ON THE WAY TO A REGIONAL SDI - THE REGIONAL ATLAS**

The authors are initiating a regional atlas of South East Europe, believing that this activity could eventually contribute to a regional spatial data infrastructure. To a user, a digital atlas is presented as a clickable map providing cartographic information and any other related information. As such, a digital atlas is traditionally self-contained and offers all data necessary on one web site.

The atlas proposed here is defined as a gateway to national spatial data infrastructures, and serves as an intermediate to provide access to the data that are nationally available. This atlas is consequently a layer on top of national data infrastructures and allows access to all data that are present in the regional spatial data infrastructure, coming from the individual nations. It remains a clickable map, but can display all data available in all underlying national infrastructures. The regional data atlas becomes thus the information system of the regional spatial data infrastructure, and constitutes a

seamless information system all over the region based on the data available in the national SDIs. It builds on the national spatial data infrastructures, but does not replace them. The atlas has to provide access to national data in respecting the policies, access rights and business models that are in use in the individual states.

One important point is that such a system has to respect existing national data formats, access rights and conditions, national or local business models, which have to be integrated into the atlas. This atlas is therefore a highly distributed system, the development of which is made possible by today's web technology, such as the semantic web and the Web Services technology, as in particular specified by the OpenGIS Consortium.

## CONCLUSIONS

The market of the countries in South Eastern Europe is small, leaving little possibilities for investment, and at the same time hinders access to new technology from the West. Nevertheless, economic and legal prospects seem positive for the widespread use of geographic information. In particular, the service sector is in its full growth. A competitive market exists, but its volume is very small. Market growth would be determined by big infrastructure projects in the areas of transport, land ownership, agriculture, and others. European accession is a driver in all countries of South East Europe, and governments are keen to adapt the national legislation to the European one, which will also have a strong impact on the use of geographic information.

Several recommendations could be formulated towards the establishment of national spatial data infrastructures. But at the end, the need for such an infrastructure has to be clearly recognized by the market decision makers, and likely market forces would show the need for accessing spatial information in a transparent and interoperable way. In particular, the establishment of Mapping Agencies is seen as an open question. Several institutions exist, whose role could be extended to assume such a role.

What might realistically happen? GI and its use will be pushed by funds from donors such as Phare or the World Bank in large infrastructure projects. The need for spatial data and transparent access conditions will be shown by those projects and eventually convince legislators to implement appropriate legislation.

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